REMARKS

As an initial item, the applicant would like to comment on some of the Examiner's positions as expressed in the Office Action dated 10/12/07.

- In paragraph 2 of the office action, examiner states "In the disclosure (P 16), the thickness of the electrodeposited layer is 0.001 inch or more, which contradicts to of what is being claimed." However, paragraph 16 is describing the primary application for electroplated plastics, that being decorative applications. Here, electrodeposit thicknesses are normally greater than 0.001 inch. However, in the next paragraph (P 17) there is discussed functional applications for electroplated plastics. There it teaches that for functional applications, "the nominal thickness of a functional electrodeposit will typically be less than that used for decorative applications (i.e. less than 0.001 inch). Thus claim 36 does indeed have a proper antecedent basis in the specification.

- In paragraph 3 of the 10/12/07 office action, the examiner states "In claim 44, there is lack of antecedent basis for "said planar structure". It is pointed out that "planar structure" appears in claim 43 from which claim 44 depends.

- In paragraph 4 of the 10/12/07 office action, the examiner states "there will be no weight given to the product by process and functional language in the claims. Applicant points out that certain processes, such as printing and extrusion, result in structure characteristic of the process. For example, claim 32 calls for the first material to be "printed". Applicant disagrees with the examiner's position when considering the limitation of "printed material". The process of printing intrinsically results in a structure, specifically a substantially two-dimensional form having a low profile. A "printed material" would be understood to have such structure. Therefore,

applicant argues that "printed material" is intrinsically a structural limitation. Regarding claim 31, an extruded structure describes a structure having a length dimension much greater than width and thickness dimensions. Regarding the functional limitations, claim 34 is intended to distinguish from a selectively plated article wherein the electrodeposited metal is primarily decorative (an automobile grille for example) and not configured to "convey current". Applicant argues that these limitations are proper in that the limitations define structural aspects characteristic of the process or function and therefore are not "product by process" limitations. These claim limitations are fully supported in the Specification as filed.

- In paragraph 4 of the 10/12/07 office action, the examiner states "The plastic substrate is an injection molded thermoplastic, acrylonitrile butadiene styrene, which is a well know rubber/elastomeric material (col 2 L 4-5 and Applicant's own disclosure page 21 line 1.)" Applicant points out that ABS is a well known, <u>rigid</u> thermoplastic, and by no means can be considered and elastomer. Hans (col 2, L 4-5 does refer to using an ABS substrate, but as a rigid "front side marker" (i.e. nameplate) for an automobile. ABS is an acronym for the terpolymer acrylonitrile butadiene styrene. It is comprised of a myriad of tiny butadiene particles dispersed in a rigid matrix of acrylonitrile stryrene. It is widely used for the conventional plating on plastics (electroless plate followed by electroplating) because of its ability to be etched, wherein the butadiene particles at the surface are etched away in strong acid to give a hydrophilic, micro-roughened surface. Regarding applicants reference (page 21 line 1), applicant refers to acrylonitrile-butadiene (NBR) rubber and styrene-butadiene (SBR) rubbers. These are copolymers which are indeed well known elastomers. It appears that the examiner has improperly grouped NBR and SBR elastomers with the rigid ABS. They are totally different materials.

- In paragraph 5 of the 10/12/07 office action, the examiner states that Kawai used "The electroconductive resin composition is comprised of an ethylene/propylene copolymer rubber material, carbon black, sulfur and trithiolcyanuric acid (or adhesion promoter) (col2 L 12-58). However, those skilled in the art readily realize that the copolymer rubbers stated there are used in minor quantities to impart impact

resistance to a rigid polypropylene homopolymer or rigid ethylene/propylene copolymer. This is a common practice and is detailed in column 3, lines 19 – 21 of Kawai et al. where it is stated "... the joint use of the propylene homopolymer or ethylene/propylene copolymer and the ethylene/propylene rubber are preferred". One realizes however, that minor additions of rubber to the matrix improves impact resistance but does not render the composition elastomeric.

In any event, the claims of the instant application, such as 40 and 41 that include the limitation of "elastomer", refers to a surface region (first surface region formed by first molded material) which is "substantially devoid of electroplated metal". Thus, even if elastomers were employed in the cited references, it would not be relevant to the instantly claimed structure.

- In paragraph 5, (and again in paragraph 6 with slightly different wording) of the 10/12/07 action, the examiner states "The examiner is taking the position that whether metal coating is patterned or not, is part of the design scheme, and only one way or the other exists (i.e. either selectively patterned or not selectively patterned). Such design scheme is conventional".

  Applicant points out with emphasis that selective metal coverage is normally far more complex than complete electrodeposit coverage of a substrate. The examiner's position completely ignores the specialized, complex and most often difficult aspects of producing a selectively electroplated article as compared with a completely electroplated article. A first consideration is the definition of the boundary line between the plated and unplated surfaces. One normally requires this to be as smooth and defined as possible. However, this goal can be difficult, as verified in the Hans U.S. Patent 4,224,118 at column 1, lines 35-45. Electrodeposits have a tendency to preferentially deposit at an edge between conductive and nonconductive regions. This situation can result in a ragged or raised edge of electrodeposited metal at the boundary. Conventional masking techniques may aggravate this problem through the electrodeposit attack on the mask edge. Moreover, with relatively thick electrodeposits the extra stresses associated with the increased electrodeposit thickness at edges actually cause the metal to pull away from the substrate. Thus, adhesion values can be of added concern in a selectively electroplated article. Alternately, if the substrate is in the

form of a thin film, substrate curling at edges can be a problem. A further concern is that selective electroplating often requires coverage of long, thin traces with fine line definition and good adhesion. This implies that electrodeposit thickness over the trace should be reasonably uniform and at a minimized thickness consistent with other requirements. If there is significant non-uniformity in electrodeposit thickness, aesthetic and performance issues arise. Using simple conductive resin substrates having low current carrying capacity (typically like those proposed by Adelman, US 4038042), slow coverage rates will lead to significant variations in electrodeposit thickness over extended lengths. Therefore, the recognition of the importance of a "coverage rate accelerator" in the directly electroplateable resins of the instant invention is critical.

Noting the above, it is simply not proper for one to say that "selective electroplating" differs only in design choice from "full coverage" electroplating. As taught in the instant specification (paragraphs 0052 – 0055), it is only through his independent and private development that the author is aware of the suitability of directly electroplateable resin technology for the unique challenges posed in production of a myriad of selectively electroplated structures.

- In paragraph 5 of the 10/12/07 office action, the examiner states "Kawai does not stated any specific structure of his article, the examiner is taking the position that Kawai's electroplated article is a planar web structure". Kawai examples consisted of molded plates of dimension (80mm X 160mm X 2mm) . Further in paragraph 6 examiner states "The examiner also takes the position that Adelman's article is a planar web structure." Adelman's examples taught a molded 6 inch tensile dumbbell substrate. However, the applicant has clearly defined the structure of a web in both words and drawings in the Specification as filed. See for example,

Spec Paragraph (0117)

-Figures 12-14 represent an embodiment of a structure useful for the interconnection of photovoltaic cells. A supporting substrate structure which takes the form of a substantially planar solid or foam web is generally indicated by 50.

-Width X-51 defines first and second terminal edges 56 and 57 respectively. Electrically conductive region 51 also has a bottom

surface 58, length Y-51 and thickness Z-51. It is envisioned that Y-51 can be much greater than X-51 such that unit of substrate 50 could be processed in a "continuous" roll-to-roll fashion.

Spec Paragraph (0118)

-Figure 13A shows joining of three substrate units 50 achieved by joining the terminal edge 57 of a first sheet 51 to the insulating joining portion 52 of another unit. Such joining can be achieved in a number of ways such as coextrusion, heat bonding, adhesive joining etc.

Spec Paragraph (0119)

-It is contemplated that electrically conductive sheets 51 may comprise materials in addition to the electrically conductive polymer. For example, a metal may be electrodeposited to the electrically conductive polymer for increased conductivity. In this regard, the use of a directly electroplateable resin (DER) may be particularly advantageous. DER's cover with metal rapidly by lateral growth of electrodeposit. In addition, selective metal coverage of a multi-material structure is readily achieved when one of the materials is DER.

-For reasons previously taught in this disclosure, a sheet 51 comprising a DER is eminently suitable to achieve such selective deposition, especially on the expansive surfaces envisioned for many solar collectors. The fact that DER's are readily fabricated either as bulk compositions or coatings qualifies DER's as being eminently suitable to accomplish selective electrodeposition using web processing.

Spec Paragraph (0120)

-Referring now to FIG. 15, the starting material for yet another embodiment is illustrated in plan view. Web, mesh, or fabric strip 70 is characterized by having a width "W" and a length "L". It is contemplated that length "L" can be considerably greater than width "W". Thus length "L" could be generally described as "continuous" or being able to be processed in a roll-to-roll fashion.

It is clear that applicant has gone to considerable effort to define in his specification and drawings that the meaning of a web is an expansive sheetlike surface which may have a length dimension suitable for roll-to-roll processing. This is also consistent with the "industrial plain language" meaning of the word "web" (see for example Wikipedia/web manufacturing). It is not reasonable to describe either the plate substrates of Kawai examples (80mm X 160mm X 2mm) or

the dumbbell substrates of Adelman as web structures, since “web” is so clearly defined in the instant specification and also by “plain industrial meaning” of a “web”

- In Paragraph 6 of the 10/12/07 office action, the examiner states “The examiner takes “directly electroplated” with the meaning of no surface pre-treatment”. Applicant agrees with this meaning. Examiner seems to imply, however, that the Adelman reference U.S. 4038042 teaches “direct electroplating”. This position is inconsistent with the meaning she gives to “directly electroplated”. Adelman teaches many surface pretreating steps prior to electroplating. This patent teaches conductive polymeric compositions which can be electroplated following multiple preplating steps (column 17, line 9 and column 20, lines 13 – 23) employing a vigorous chromic/sulfuric etch plus neutralizing rinse. The Adelman compositions thus are not “directly electroplateable resins” according to the examiner’s own definition. The Adelman teaching requires as many as eight preplating steps of etching, neutralization soaking and rinsing of the surface prior to electrodeposition. For instance, in Adelman’s Example 1, Column 20, lines 13 through 23, eight preplating steps are listed taking in excess of 23 minutes to achieve. Thus, Adelman does not teach a “directly electroplateable resin”.

CLAIM REJECTIONS

35 USC # 112

1. Claim 36 was rejected as having the specification contradicting what is being claimed. However, examiner’s citation of Paragraph 16 is incomplete. When read in conjunction with Paragraph 17, claim 36 is seen to comply with the written description requirement.

2. Claims 39, 40 and 44 were rejected as unclear. Claims 39 and 40 have been amended in the instant Amendment in response to the rejection. As pointed out above, claim 44 appears to have proper antecedent in claim 43 from which it depends.

35 USC # 102/103

1. **Hans (U.S. 4224118)** The examiner rejected many claims in the 10/12/07 office action as anticipated by Hans (U.S. 4224118). Hans teaches application of a mask coating (otherwise known to the art as a "stop-off" coating) to an ABS article prior to conventional 2-stage "electroless + electroplating" treatment. The mask comprises specialty materials resistant to the etching solution so that the masking material does not accept the catalyst which initiates the first stage "electroless" metal plating. "Electroless" plating therefore occurs only on the unmasked exposed surface regions of the rigid ABS substrate. Specialty materials are required for mask coatings and are therefore expensive. Such masking is extremely laborious and costly. The mask material must further be dried/baked (stated as 10 minutes at 140 degrees F in the example of U.S. 4,224,1180). Finally, the mask material is still susceptible to attack and deterioration by the vigorous etching and electroplating. In the case of a permanent, robust mask such as taught in U.S. 4,224,118, the mask material still is deleteriously altered. This reference suggests such alteration could be painted or buffed (column 2, lines 33 – 37), either of which would add expense, complexity and labor. In the case of a removable mask, such removal requires additional processing including solvent washing and waste containment. Either situation involves considerable additional expense, complication and waste. The Hans reference not only involves difficult and expensive preparation of the ABS substrate but also a difficult and expensive "preplate" metallization process for producing the conductive surface upon which subsequent electrodeposition is to be performed. The "preplate" metallization is complicated, time consuming and uses expensive chemicals which are environmentally difficult. Pollution control and containment adds to cost. Thus, the cited U.S. Patent 4,224,118 to Hans teaches a very restricted substrate (ABS) using a very restricted fabrication (injection molding) using a very laborious and environmentally difficult process (mask spraying) in combination with a very expensive, complicated and environmentally difficult preplating process (conventional electroless metal deposition). These problems are just some of issues the instant invention solves.

Moreover, Hans teaches a completely different structure for his selectively plated articles compared to that of the instant application. This may be best illustrated in the sectional drawings "A" and "B" below comparing a typical Hans structure with that of the instant application. Figure "A", the Hans structure, is produced by applying a mask to the surface of a substrate in a pattern leaving exposed regions of substrate. Exposure to "electroless preplating" steps accomplishes deposition of metal onto the exposed regions of substrate, and this is then followed by electroplating of metal. In contrast, as shown in Figure "B", the articles of the instant application are produced by applying a pattern of directly electroplateable resin (DER) on the surface of a substrate and subsequently directly electroplating a metal. While both techniques result in selective metal placement, there are fundamental and important processing, structural and functional differences.

In Hans, the metal is deposited in direct contact with the substrate. This significantly limits choices for the substrate to those materials which are receptive to the electroless preplating steps. For example, many common materials such as PVC and PET, ceramics and glass would likely be unsuitable as substrates. In sharp contrast, the instant application teaches forming a pattern of DER on virtually any substrate, including all common web and film materials such as PET.

Furthermore in Hans a masking material (i.e. a material not receptive to electroless preplating steps) is required. Masking of course represents an additional material involving processing, material cost and additional potential for difficulty. In the instant application (Figure B) no mask is used. In a masking approach such as Hans, problems of mask deterioration persist. There is also a tendency during deposition for the electrodeposit to "chip away" at the edges (such as indicated at arrow "1" of Figure A) of the mask and result in a ragged edge. This is the result of the well-known characteristic of electrodeposits to mechanically attack the edge of a mask, a characteristic identified by Hans in his disclosure at column 1, lines 35-45. Hans proposed to improve this situation using a very limited combination of masking material and substrate. In the instant application, applicant teaches a structure requiring no mask. Therefore, no chemical or mechanical mask deterioration is possible. Further, as seen in Figure B, the instant the DER is covered with electrodeposit, there is no edge for subsequent electrodeposit to "chip away". A very precise clean edge results. Finally, the instant

application does away with the harsh chemicals and extended processing taught by Hans.

- The Hans patent actually <u>teaches away</u> from the success of the selectively electroplated articles of the instant invention. If one were to propose using the masking technique of Hans to produce a selectively electroplated article using a DER substrate, many potential functional attributes of the selectively plated structure would be lost. The reason is depicted in the hypothetical sectional drawing "C" showing a structure resulting from combining the Hans "masking" with a DER substrate. It is readily apparent that the Figure "C" structure does not electrically isolate the multiple electrodeposit traces, since the DER is at least semi-conductive in nature and will provide conductivity between those traces. In addition, the mask deterioration issues pointed to above would be present.

In conclusion, applicant avers that Hans simply teaches a variation (mask composition) on conventional techniques to achieve selective metal deposition on plastic (ABS) substrates. It teaches nothing relevant to (and indeed teaches away from) the novel structures taught by the instant application.

2. **<u>Adelman (U.S. 4,038,042)</u>** The Examiner rejected claims in the 10/12/07 office action on the basis of Adelman (US 4038042). Adelman teaches carbon filled polyolefin compositions which are electroplated after multiple pretreatments to render the surface hydrophilic and promote adhesion of the electrodeposit (column 17, line 9 and column 20, lines 13 – 23). The pretreatments employ vigorous chromic/sulfuric acid etching plus neutralizing rinses. The Adelman compositions thus are not "directly electroplateable resins" according to the examiner's own definition. The Adelman teaching requires as many as eight preplating steps of etching, neutralization soaking and rinsing of the surface prior to electrodeposition (for instance, in Adelman's Example 1, Column 20, lines 13 through 23, eight preplating steps are listed taking in excess of 23 minutes to achieve). Thus, Adelman does not teach a "directly electroplateable resin".
   In addition to the fact that Adelman does not teach a "directly electroplateable resin" <u>as defined by both the examiner and the applicant</u>, number of other facts render Adelman improper as a prior art reference regarding the instant application.

- The vigorous etches and rinses taught by Adelman could affect the <u>nonplated</u> surfaces of a selectively electroplated article in a dramatically deleterious way, both mechanically and visually.
- The Adelman compositions did not have a "coverage rate accelerator" as required in all claims of the instant invention. Thus, reported electrodeposit coverage rates were slow, at best in the range of 1 inch/minute (see Tables V-VII of the Adelman patent). This is too slow to be of practical value, since it would result in exceedingly long coverage times and substantial nonuniformity in electrodeposit thickness, especially if attempts were made to cover long thin traces of low current carrying capacity. But long traces or thin material cross sections are often characteristic of selectively electroplated articles, dictated for functional performance, processing demands or minimization of cost.
- Electrodeposit thicknesses of .001 to .0015 inch were taught by Adelman in his Examples. These thicknesses are consistent with typical bright decorative plating. Indeed, Adelman states in the Summary Of The Invention that a primary object of the invention "to give bright reflective surface finishes with desirable mechanical properties" (Column 4, lines 34-40). However, such thicknesses

would normally be unsuitable to achieve the fine line definition often required for many selectively electroplated articles.

It is clear that Adelman did not teach a "directly electroplateable resin" as taught in the instant application. His compositions required extensive pretreating steps prior to electroplating. His compositions did not include a coverage rate accelerator, and thus reported coverage rates were too slow to be of practical value for most selectively plated articles. Finally, Adelman is notably silent about the possibility of his compositions and techniques as suitable for the unique and demanding requirements involved in selective electrodeposition. Thus the Adelman patent teaches nothing relevant to (and indeed teaches away from) the novel structures of the instant application.

2. **<u>Kawai et al. (U.S. 4,425,262)</u>** The Examiner in the 10/12/07 office action rejected claims base on Kawai et al. (US 4425262). Kawai et al. teach polyolefin compositions further comprising carbon black, sulfur and trithiolcyanuric acid as directly electroplateable resins. A number of factors render the Kawai et al. reference inapplicable as an anticipatory reference regarding the instant application and claims.

- The Examiner states that "Kawai does not state any specific structure of his article, and the examiner is taking the position that Kawai's electroplated article is a planar web". However, Kawai's examples did indeed state a specific structure, that being flat rigid plates 2mm (.08 in.) thick. Examiner's position that the Kawai articles constitute a planar web as clearly defined in the specification and figures of the instant application is untenable.
- Kawai et al. teach a non-discriminating electroplating technique. The reference makes no mention of the unique suitability of a directly electroplateable resin for the specialized requirements of selective electroplating as taught in the instant specification. As noted by the examiner, "Kawai et al. is silent about the metal coating is patterned or selectively plated". Indeed, the reference is not only silent, it teaches away from such selectivity. The reference examples describe flat plaques, about .08 inch thick. The plaques are plated with electrodeposits some .002 inch thick. While such large thicknesses may be appropriate (and indeed advantageous) for an article <u>entirely covered or encapsulated</u> with electrodeposit such as the Kawai plates,

such thicknesses could be inappropriate for a selectively electroplated article because of the problems discussed above regarding edge effects, electrodeposit stresses and surface irregularities that increase at such thicknesses. Finally, there is no recognition or teaching in Kawai that the sulfur and trithiolcyanuric acid present function as a coverage rate accelerator. The reference only teaches improving electrodeposit adhesion from these additions. There is simply no mention or teaching of improving initial electrodeposit coverage rates, critical in the success of electroplating thin metal traces often encountered in selective electroplating. Without actually performing controlled experiments, one thus does not know whether the combination of sulfur and trithiolcyanuric acid would improve coverage rates, since Kawai et al. do not report such an improvement. Finally, there is no evidence that the Kawai technology ever achieved any commercial success. The Kawai patent has only been referenced twice in U.S. patents in the 24 years since the patent issued, and both of those patents were issued to the instant applicant. Thus, neither the patent teaching nor commercial experience would persuade a person of normal skill in the art to choose the Kawai et al. teachings for selective electroplated structures.

Applicant submits that the claims of the instant application are in condition for allowance, and a Notice Of Allowance is respectfully requested. If, on the basis of the foregoing claim amendments and remarks, the examiner is not convinced that such Notice Of Allowance is proper, applicant requests that the examiner contact him by telephone at his home number, 408-779-1465.

Respectfully submitted,

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